What is claimed is:

1. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the Mo occurs as dispersed Mo oxide clusters and the majority of the Co occurs in a $CoMoO_4$-like phase with the Co therein primarily in an octahedral configuration, and wherein the $CoMoO_4$-like phase occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a temperature between about 700°C and about 800°C and maintaining a CO_2 concentration in the reactor below a threshold CO_2 concentration above which the conversion of ionic Co to metallic Co is inhibited, wherein the majority of the single walled carbon nanotubes thus formed have a diameter between about .7 nm to about .9 nm.

2. The method of claim 1 wherein in the step of providing a catalyst, the support material is silica.

3. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.

4. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO_2 concentration in the reactor is 1%.

5. The method of claim 1 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon-containing gas is CO.

6. The method of claim 1 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.

7. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 1.

8. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the Mo occurs as dispersed Mo oxide clusters and the majority of the Co occurs in a $CoMoO_4$-like phase with the Co therein primarily in an octahedral configuration, and wherein the $CoMoO_4$-like phase occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a temperature between about 800°C and about 900°C and maintaining a CO_2 concentration in the reactor below a threshold CO_2 concentration above which the conversion of ionic Co to metallic Co is inhibited, wherein the majority of the single walled carbon nanotubes thus formed have a diameter between about .9 nm to about 1.2 nm.

9. The method of claim 8 wherein in the step of providing a catalyst, the support material is silica.

10. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.

11. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO_2 concentration in the reactor is 1%.

12. The method of claim 8 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon containing gas is CO.

13. The method of claim 8 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.

14. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 8.

15. A method of preferentially forming single walled carbon nanotubes having a particular diameter, comprising:

providing a catalyst comprising:

Co and Mo disposed on a support material wherein the majority of the Mo occurs as dispersed Mo oxide clusters and the majority of the Co occurs in a $CoMoO_4$-like phase with the Co therein primarily in an octahedral configuration, and wherein the $CoMoO_4$-like phase occurs substantially disposed upon the dispersed Mo oxide clusters; and

exposing the catalyst in a reactor to a carbon-containing gas at a temperature between about 900°C and about 1,000°C and maintaining a CO_2 concentration in the reactor below a threshold CO_2 concentration above which the conversion of ionic Co to metallic Co is inhibited, wherein the majority of the single walled carbon nanotubes thus formed have a diameter between about 1.3 nm to about 1.7 nm.

16. The method of claim 15 wherein in the step of providing a catalyst, the support material is silica.

17. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the reactor has a pressure therein between about 1 atm and 7 atm.

18. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the threshold CO_2 concentration in the reactor is 1%.

19. The method of claim 15 wherein in the step of exposing the catalyst to a carbon-containing gas, the carbon-containing gas is CO.

20. The method of claim 15 comprising the additional step of reducing the catalyst by exposing the catalyst to a heated hydrogen gas.

21. A carbon nanotube product comprising a catalyst and single-walled carbon nanotubes associated therewith, the carbon nanotube product produced by the method of claim 15.